

# UK Patent Application (19) GB (11) 2 284 833 (13) A

(43) Date of A Publication 21.06.1995

(21) Application No 9322608.2

(22) Date of Filing 02.11.1993

(71) Applicant(s)

Steven Frederick Finch  
Priory House, Beckford, TEWKESBURY, Glos,  
GL20 7AA, United Kingdom

William Reginald Ney  
11 Rayleigh Close, MACCLESFIELD, Cheshire,  
United Kingdom

(72) Inventor(s)

Steven Frederick Finch  
William Reginald Ney

(74) Agent and/or Address for Service

Steven Frederick Finch  
Priory House, Beckford, TEWKESBURY, Glos,  
GL20 7AA, United Kingdom

(51) INT CL<sup>6</sup>  
D21F 7/00, D21H 21/02

(52) UK CL (Edition N )  
D2A AV A210  
D1R RHA R318 R514

(56) Documents Cited

GB 2251868 A      GB 0977094 A      GB 0659784 A  
EP 0551970 A1      EP 0550230 A1      EP 0359590 A1  
US 4861429 A  
WPI Abstract Accession No.82-03394J/48  
&JP570171790

(58) Field of Search

UK CL (Edition M ) D1R REX RHA , D2A ABG AJA AJD  
AV AX  
INT CL<sup>5</sup> D21F 7/00 7/08 , D21H 21/02 21/04  
Online databases:WPI

(54) Inhibiting the deposition of sticky particles on paper mill dryer fabrics

(57) The deposition of sticky particles on dryer fabrics of paper-making machinery is inhibited by continuously applying to the fabric a sacrificial coating, suitably of cationic or amine active silicone fluids or of dimethyl siloxane emulsion. The particles adhere to the coating film and are subsequently removed therewith.

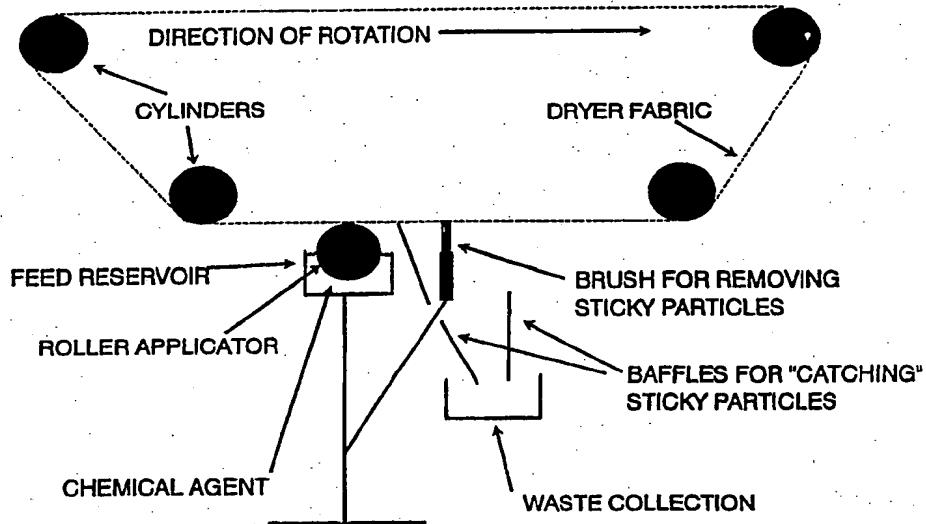


FIGURE 1

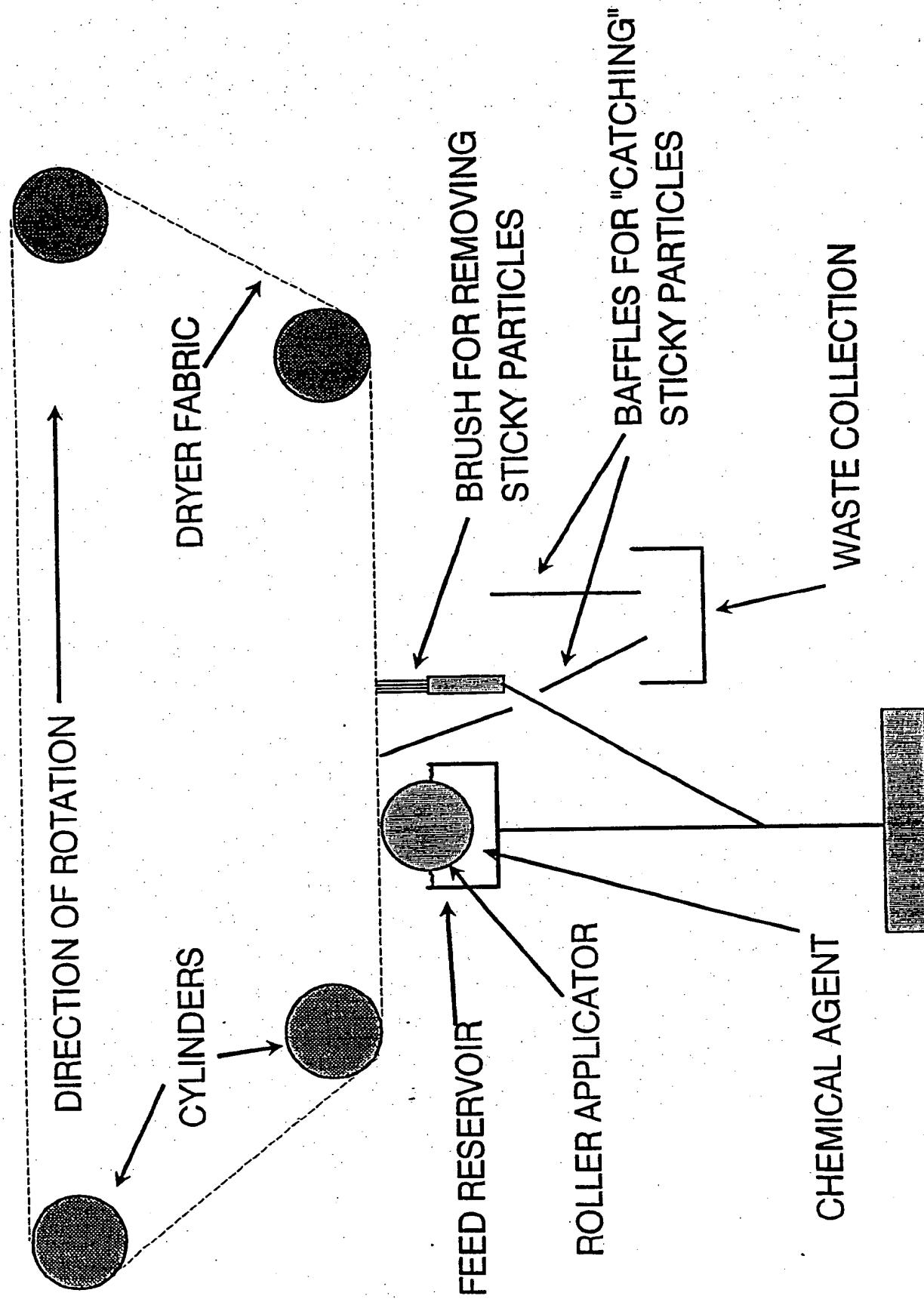


FIGURE 1

2284833

REQUEST FOR PATENT:

SUBJECT:

THE CONTROL OF THE DEPOSITION OF STICKY PARTICLES  
ON PAPER MILL DRYER FABRICS

SUMMARY & OUTLINE OF THE INVENTION:

This invention relates to the control of the laydown and adhesion of sticky particles on dryer fabrics used in the industrial manufacture of paper and board.

The invention is designed to inhibit the laydown of these sticky particles on dryer fabrics by providing a continuous "sacrificial" hydrophobic coating to the fabric.

Detailed laboratory analysis (summary below) has confirmed that the provision of a hydrophobic coating to samples of the dryer fabric provides a film which has an affinity to attract the sticky particles. These particles can then be surrendered to a suitably designed removal device, thus protecting the fabric.

BACKGROUND:

Financial and environmental considerations in recent years have accentuated the use of waste and recycled paper in the manufacture of paper and board. These waste and recycled materials do, however, bring with them undesirable contaminants that can have a significant impact on the paper making process and on the paper machine and associated equipment.

Typically occurring contaminants include:

- Latexes
- Hot melt adhesives
- Adhesive tape
- Sticky labelling materials

As a result of their insolubility, these contaminants remain in the paper making process stream and are physically transported with the paper web. Their sticky nature, however, means that they are prone to deposit on hydrophobic surfaces such as the forming fabric, press felts and more significantly, as a result of the higher temperatures achieved, in the dryer section, on the dryer fabric.

IMPACT OF STICKY DEPOSITS ON DRYER FABRICS

The build up of sticky deposits on the dryer fabrics results in a number of operational and financial penalties for the paper manufacturer, including:

1 Loss of porosity and drying capacity, resulting in the slowing down of the machine and the consequent reduction in the paper or board production rate.

2 Quality deterioration, as the sticky materials "pick" holes in the paper sheet resulting in problems downstream, both in off-grade finished product and in problems in subsequent coating processes.

3 The build up of sticky materials necessitates the shutdown of the paper machine for cleaning of the fabric and/or replacement. "Off-line" cleaning of fabrics is generally carried out using Sodium or Potassium Hydroxide and solvent based cleaning chemicals which can be both costly and hazardous in use and disposal.

4 Loss of drying capacity results in increased energy consumption as steam utilisation is increased to provide additional heat for drying the paper or board.

#### DETAILS OF THE INVENTION:

The invention comprises a chemical additive programme and the equipment and methodology of application to and removal from the dryer fabric.

The technology utilised to inhibit the adhesion of the sticky particles is to apply a thin hydrophobic film of silicone based fluid to the surface of the fabric which is in contact with the paper sheet, just prior to the point of contact of the fabric with the paper sheet.

As the sticky particles melt and adhere to the fabric during the pass over the drying cylinders, they become bonded to the silicone film. During the next circuit of the fabric around the cylinders, the silicone film and the associated sticky particles are removed from the fabric to waste.

The schematic of the applicator and removal system is shown in figure No.1.

Initial work on this subject has centred on the use of silicone fluids, particularly cationic, amine active and polydimethyl siloxane emulsions. Excellent inhibition of sticky particle deposition and adhesion has been achieved with each of these materials.

#### LABORATORY EVALUATION AND ANALYSIS:

A piece of dryer fabric was cut into a number of equally sized and shaped test pieces. These test specimens were then utilised in evaluations using silicone fluids, as outlined above, made up to 1 percent solutions using tap water

Four separate beakers were prepared and numbered 1 - 4. No.1 contained tap water as a blank reference, No.2 contained cationic silicone fluid, No.3 contained amine active silicone fluid and No.4 contained dimethyl siloxane emulsion.

Samples of the dryer fabric were placed in each of the beakers for a period of 30 seconds, they were then removed drained and shaken dry for a period of 20 seconds.

Test pieces of two-sided "Nitto" tape were stuck onto each specimen piece of the dryer fabric and they were then placed in an oven at 95 degrees centigrade for a period of 15 minutes. (R.T.H.)

When the specimens were removed from the oven the "Nitto" tape was peeled off and a qualitative assessment of the amount of sticky material left adhering to the fabric was made.

The results indicated that a significant amount of adhesive remained on the blank test specimen whereas the treated specimens showed little or no remaining adhesive. The order of cleanliness was:

Cleanest:	No.3
Second:	No.1
Third	No.2

This same procedure was repeated using paper backed adhesive tape and reel splicing tape, the results were as follows:

Paper-backed adhesive tape.		Reel splicing tape.
Cleanest	No.3	No.3
Second	No.1	No.2
Third	No.2	No.1

#### PRELIMINARY CONCLUSIONS:

- 1 The quantity of sticky materials left adhering to the dryer fabric samples decreased significantly with the use of the additives.
- 2 Additive No.3 was consistently the best performer under the conditions of this test.

#### SECONDARY EVALUATIONS:

In order to quantify the reduction in the adhesion of the sticky particles to the dryer fabric, a modified tensile test was carried out.

#### PROCEDURE:

Fresh pieces of dryer fabric were cut into strips 15mm wide and 120mm long for use on the standard tensile tester. These strips were paired off and soaked in the solutions as above. They were then dried in the oven at 95 degrees centigrade for a period of 15 minutes, simulating the contact of the fabric with the drying cylinders prior to contact with the paper sheet.

The pairs of treated fabrics and the untreated blank pair were removed from the oven and joined together using two-sided adhesive tape. Each joined pair was then pressed using a standard laboratory hand press for 1 minute to ensure uniformity of adhesion.

Each sample pair was then subjected to the standard tensile test to ascertain the pressure required to separate the joined samples. The following table shows the pressure, in psi., needed to separate the joined pieces of fabric.

<b>SAMPLE:</b>	<b>PRESSURE:</b>
BLANK	40 psi.
No.1	8.6 psi.
No.2	8.4 psi
No.3	2.9 psi

#### **CONCLUSIONS:**

As can be seen, the pressure required to separate all of the treated samples was significantly lower than in the untreated case.

Additive No. 3 was again the most effective on an equivalent dose rate basis.

The pairs of treated fabrics and the untreated blank pair were removed from the oven and joined together using two-sided adhesive tape. Each joined pair was then pressed using a standard laboratory hand press for 1 minute to ensure uniformity of adhesion.

Each sample pair was then subjected to the standard tensile test to ascertain the pressure required to separate the joined samples. The following table shows the pressure, in psi., needed to separate the joined pieces of fabric.

SAMPLE:	PRESSURE:
BLANK	40 psi.
No.1	8.6 psi.
No.2	8.4 psi
No.3	2.9 psi

#### CONCLUSIONS:

As can be seen, the pressure required to separate all of the treated samples was significantly lower than in the untreated case.

Additive No. 3 was again the most effective on an equivalent dose rate basis.

**CLAIMS:**

- 1 A programme of inhibiting the laydown and adherence of sticky particles on dryer fabrics used in the industrial manufacture of paper and board.
- 2 The utilisation of a continuously applied hydrophobic layer to a dryer fabric such that sticky particles adhere to this layer rather than to the dryer fabric itself.
- 3 The utilisation of cationic and amine active silicone fluids and of dimethyl siloxane emulsion to provide this hydrophobic layer to the dryer fabric.
- 4 The utilisation of a continuous applicator of the fluid required to provide the hydrophobic layer to the fabric along with a device as shown in figure 1 to remove the sticky particles prior to the subsequent addition of the fluid.

---

**Amendments to the claims have been filed as follows**

- 1 An "on-line", continuous method of inhibiting the laydown and adherence of sticky particles on dryer fabrics used in the industrial manufacture of paper and board.
- 2 The utilisation of a continuously applied, silicone based, hydrophobic layer to a dryer fabric, such that sticky particles adhere to this layer rather than to the dryer fabric itself.
- 3 The utilisation of either cationic, amine active silicone fluids, or of dimethyl siloxane emulsion to provide this hydrophobic layer to the dryer fabric.
- 4 The utilisation of a continuous "mist applicator" of the fluid required to provide the hydrophobic layer to the fabric along with a device as shown in figure 1 to remove the sticky particles prior to the subsequent addition of the fluid.

Patents Act 1977  
 Examiner's report to the Comptroller under Section 17  
 (The Search report)

Application number  
 GB 9322608.2

Relevant Technical Fields

(i) UK Cl (Ed.M) DIR (REX, RHA); D2A (ABG, AJA, AJD, AV, AX)  
 (ii) Int Cl (Ed.5) D21F 7/00, 7/08; D21H 21/02, 21/04

Search Examiner  
 MR A LITTLEJOHN

Date of completion of Search  
 12 DECEMBER 1994

Databases (see below)

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

Documents considered relevant following a search in respect of Claims :-  
 1-4

(ii) ONLINE DATABASES: WPI

Categories of documents

X: Document indicating lack of novelty or of inventive step. P: Document published on or after the declared priority date but before the filing date of the present application.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category. E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

A: Document indicating technological background and/or state of the art. &: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2251868 A	(GRACE) see whole document eg page 2 lines 14 to 24	1
X	GB 0977094	(NALCO) see whole document, eg page 4 lines 41-47	1, 3
X	GB 0659784	(HELLEFORS) see whole document	1
X	EP 0551970 A1	(DEARBORN) see whole document, eg page 3 lines 2-4	1
X	EP 0550230 A1	(BETZ) see whole document, eg page 3 line 30 - page 4 line 1	1
X	EP 0359590 A2	(DEARBORN) see whole document, eg page 9 lines 51-62	1
X	US 4861429	(BARNETT) see whole document, eg column 2 lines 44-51	1
X	WPI Abstract Accession No. 82-03394J/48 and JP 570171790 (NIPPON FELT) 22 October 1982 (see abstract)		1, 2, 3

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).

**2284833**

**REQUEST FOR PATENT:**

**SUBJECT:**

**THE CONTROL OF THE DEPOSITION OF STICKY PARTICLES  
ON PAPER MILL DRYER FABRICS**

**SUMMARY & OUTLINE OF THE INVENTION:**

This invention relates to the control of the laydown and adhesion of sticky particles on dryer fabrics used in the industrial manufacture of paper and board.

The invention is designed to inhibit the laydown of these sticky particles on dryer fabrics by providing a continuous "sacrificial" hydrophobic coating to the fabric.

Detailed laboratory analysis (summary below) has confirmed that the provision of a hydrophobic coating to samples of the dryer fabric provides a film which has an affinity to attract the sticky particles. These particles can then be surrendered to a suitably designed removal device, thus protecting the fabric.

**BACKGROUND:**

Financial and environmental considerations in recent years have accentuated the use of waste and recycled paper in the manufacture of paper and board. These waste and recycled materials do, however, bring with them undesirable contaminants that can have a significant impact on the paper making process and on the paper machine and associated equipment.

Typically occurring contaminants include:

- Latexes
- Hot melt adhesives
- Adhesive tape
- Sticky labelling materials

As a result of their insolubility, these contaminants remain in the paper making process stream and are physically transported with the paper web. Their sticky nature, however, means that they are prone to deposit on hydrophobic surfaces such as the forming fabric, press felts and more significantly, as a result of the higher temperatures achieved, in the dryer section, on the dryer fabric.

**IMPACT OF STICKY DEPOSITS ON DRYER FABRICS**

The build up of sticky deposits on the dryer fabrics results in a number of operational and financial penalties for the paper manufacturer, including:

1 Loss of porosity and drying capacity, resulting in the slowing down of the machine and the consequent reduction in the paper or board production rate.

2 Quality deterioration, as the sticky materials "pick" holes in the paper sheet resulting in problems downstream, both in off-grade finished product and in problems in subsequent coating processes.

3 The build up of sticky materials necessitates the shutdown of the paper machine for cleaning of the fabric and/or replacement. "Off-line" cleaning of fabrics is generally carried out using Sodium or Potassium Hydroxide and solvent based cleaning chemicals which can be both costly and hazardous in use and disposal.

4 Loss of drying capacity results in increased energy consumption as steam utilisation is increased to provide additional heat for drying the paper or board.

#### DETAILS OF THE INVENTION:

The invention comprises a chemical additive programme and the equipment and methodology of application to and removal from the dryer fabric.

The technology utilised to inhibit the adhesion of the sticky particles is to apply a thin hydrophobic film of silicone based fluid to the surface of the fabric which is in contact with the paper sheet, just prior to the point of contact of the fabric with the paper sheet.

As the sticky particles melt and adhere to the fabric during the pass over the drying cylinders, they become bonded to the silicone film. During the next circuit of the fabric around the cylinders, the silicone film and the associated sticky particles are removed from the fabric to waste.

The schematic of the applicator and removal system is shown in figure No.1.

Initial work on this subject has centred on the use of silicone fluids, particularly cationic, amine active and polydimethyl siloxane emulsions. Excellent inhibition of sticky particle deposition and adhesion has been achieved with each of these materials.

#### LABORATORY EVALUATION AND ANALYSIS:

A piece of dryer fabric was cut into a number of equally sized and shaped test pieces. These test specimens were then utilised in evaluations using silicone fluids, as outlined above, made up to 1 percent solutions using tap water.

Four separate beakers were prepared and numbered 1 - 4. No.1 contained tap water as a blank reference, No.2 contained cationic silicone fluid, No.3 contained amine active silicone fluid and No.4 contained dimethyl siloxane emulsion.

Samples of the dryer fabric were placed in each of the beakers for a period of 30 seconds, they were then removed drained and shaken dry for a period of 20 seconds.

(K.T.M.)  
Test pieces of two-sided "Nitto" tape were stuck onto each specimen piece of the dryer fabric and they were then placed in an oven at 95 degrees centigrade for a period of 15 minutes.

When the specimens were removed from the oven the "Nitto" tape was peeled off and a qualitative assessment of the amount of sticky material left adhering to the fabric was made.

The results indicated that a significant amount of adhesive remained on the blank test specimen whereas the treated specimens showed little or no remaining adhesive. The order of cleanliness was:

Cleanest:	No.3
Second:	No.1
Third	No.2

This same procedure was repeated using paper backed adhesive tape and reel splicing tape, the results were as follows:

	Paper-backed adhesive tape.	Reel splicing tape.
Cleanest	No.3	No.3
Second	No.1	No.2
Third	No.2	No.1

#### PRELIMINARY CONCLUSIONS:

- 1 The quantity of sticky materials left adhering to the dryer fabric samples decreased significantly with the use of the additives.
- 2 Additive No.3 was consistently the best performer under the conditions of this test.

#### SECONDARY EVALUATIONS:

In order to quantify the reduction in the adhesion of the sticky particles to the dryer fabric, a modified tensile test was carried out.

#### PROCEDURE:

Fresh pieces of dryer fabric were cut into strips 15mm wide and 120mm long for use on the standard tensile tester. These strips were paired off and soaked in the solutions as above. They were then dried in the oven at 95 degrees centigrade for a period of 15 minutes, simulating the contact of the fabric with the drying cylinders prior to contact with the paper sheet.

The pairs of treated fabrics and the untreated blank pair were removed from the oven and joined together using two-sided adhesive tape. Each joined pair was then pressed using a standard laboratory hand press for 1 minute to ensure uniformity of adhesion.

Each sample pair was then subjected to the standard tensile test to ascertain the pressure required to separate the joined samples. The following table shows the pressure, in psi., needed to separate the joined pieces of fabric.

SAMPLE:	PRESSURE:
BLANK	40 psi.
No.1	8.6 psi.
No.2	8.4 psi
No.3	2.9 psi

#### CONCLUSIONS:

As can be seen, the pressure required to separate all of the treated samples was significantly lower than in the untreated case.

Additive No. 3 was again the most effective on an equivalent dose rate basis.

**CLAIMS:**

- 1 A programme of inhibiting the laydown and adherence of sticky particles on dryer fabrics used in the industrial manufacture of paper and board.
- 2 The utilisation of a continuously applied hydrophobic layer to a dryer fabric such that sticky particles adhere to this layer rather than to the dryer fabric itself.
- 3 The utilisation of cationic and amine active silicone fluids and of dimethyl siloxane emulsion to provide this hydrophobic layer to the dryer fabric.
- 4 The utilisation of a continuous applicator of the fluid required to provide the hydrophobic layer to the fabric along with a device as shown in figure 1 to remove the sticky particles prior to the subsequent addition of the fluid.

---

**Amendments to the claims have been filed as follows**

- 1 An "on-line", continuous method of inhibiting the laydown and adherence of sticky particles on dryer fabrics used in the industrial manufacture of paper and board.
- 2 The utilisation of a continuously applied, silicone based, hydrophobic layer to a dryer fabric, such that sticky particles adhere to this layer rather than to the dryer fabric itself.
- 3 The utilisation of either cationic, amine active silicone fluids, or of dimethyl siloxane emulsion to provide this hydrophobic layer to the dryer fabric.
- 4 The utilisation of a continuous "mist applicator" of the fluid required to provide the hydrophobic layer to the fabric along with a device as shown in figure 1 to remove the sticky particles prior to the subsequent addition of the fluid.

---

Patents Act 1977  
 Examiner's report to the Comptroller under Section 17  
 (The Search report)

Application number  
 GB 9322608.2

Relevant Technical Fields

(i) UK Cl (Ed.M) DIR (REX, RHA); D2A (ABG, AJA, AJD, AV, AX)

(ii) Int Cl (Ed.5) D21F 7/00, 7/08; D21H 21/02, 21/04

Databases (see below)

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE DATABASES: WPI

Search Examiner  
 MR A LITTLEJOHN

Date of completion of Search  
 12 DECEMBER 1994

Documents considered relevant following a search in respect of Claims :-  
 1-4

Categories of documents

X: Document indicating lack of novelty or of inventive step.

P: Document published on or after the declared priority date but before the filing date of the present application.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

A: Document indicating technological background and/or state of the art.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2251868 A	(GRACE) see whole document eg page 2 lines 14 to 24	1
X	GB 0977094	(NALCO) see whole document, eg page 4 lines 41-47	1, 3
X	GB 0659784	(HELLEFORS) see whole document	1
X	EP 0551970 A1	(DEARBORN) see whole document, eg page 3 lines 2-4	1
X	EP 0550230 A1	(BETZ) see whole document, eg page 3 line 30 - page 4 line 1	1
X	EP 0359590 A2	(DEARBORN) see whole document, eg page 9 lines 51-62	1
X	US 4861429	(BARNETT) see whole document, eg column 2 lines 44-51	1
X	WPI Abstract Accession No. 82-03394J/48 and JP 570171790 (NIPPON FELT) 22 October 1982 (see abstract)		1, 2, 3

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).